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Impacts of food consumption: A missing hot spot in LCA?

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ABSTRACT BOOK

SETAC Europe 26th Annual Meeting
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Environmental contaminants from land to sea: continuities and interface in environmental toxicology and chemistry

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Water availability and usage is of increasing concern in modern society (Vink & Davies, 2015). In LCA practice has been pointed out that water use is an indicator that should be assessed in the local or regional context, (Pfister, et al., 2009; Vink & Davies, 2015; others) so the use of regional data is more relevant to obtain more reliable values for this indicator. Bioeconomy is currently targeted as a strategic axis in the European Commission country members, in France particularly, it is expected to support the depletion of non-renewable resources and it is aimed to achieve a sustainable production model of biomass sources (Colloque Bioeconomie France, 2015). Bioeconomy growth could imply putting more pressure on water availability, depending on local conditions, thus it is important to review the increasing biomass uses regarding its implicit water use as an LCA indicator at regional level. As part of the bioeconomy, several biobased chemicals like biopolymers or chemical building blocks are increasing and they are expected to increase their production (NNFCC, 2015). The present work aims to contribute on sharing the experience to calculate water use as an LCA indicator, using regional inventory data for the production of wheat and corn in the regions Picardie and Alsace in France, assuming that these crops are the primary raw materials for succinic acid production in the country. Regional Life Cycle Inventories for crop production were obtained through an organization having access to specific data in the selected regions. Intermediate life stage inventories were obtained from literature, as well as from Agribalyse French database as a third inventory source for crop production, to observe differences when using average national data. Methodologies used to estimate water use are ReciPe 2008 and ILCD with adaptations to include water scarcity factors (as presented by A.M. Boulay et al., 2011). Discussion and results cover the life cycle water use in the set scenarios, and the methodological issues to estimate the LCA indicator.

TU255

The challenge of combined assessment of environmental impact and supply of essential fatty acids in omnivore and vegetarian diets

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The relationship between food and environment has been gaining attention in recent years, as a consequence, some life cycle assessment studies have taken into account not only energy or protein intake but also more sophisticated nutritional quality indicators. We used LCA methodology to assess four contrasting diets consisting of foods usually consumed in France. We investigated an Average diet, a Healthy diet, a Healthy diet without fish and a Healthy vegetarian diet, where the Healthy diets correspond to recommendations regarding macronutrients in France. Research has shown that increasing omega-3 fatty acid content of animal feed may result in higher omega-3 fatty acid content of animal products. Several non-fish products with higher omega-3 levels are available in the market in France. For each of the four diets we investigated the environmental impacts of the substitution of standard animal products (milk and beef, sheep milk, goat milk, rabbit meat, chicken, egg and pork), wheat flour and oil by the corresponding omega-3 enriched food items. To assess the environmental impacts the following impact categories were used: global warming (GWP) acidification (AC), eutrophication (EU), land occupation (LO), cumulative energy demand (CED) and biotic natural resources depletion-species (BNR-eco). Moving from Standard to increased omega-3 versions of the four diets improved nutritional quality without increasing environmental impacts. Shifting from Average diet to Healthy diet improved nutritional quality and decreased environmental impacts by 10 to 30 % depending on the impact. Shifting from Average to Vegetarian diet reduced environmental impacts by 11% to 49%, but decreased nutritional quality in terms of omega-3 contents. These results highlight the challenges of carrying out LCA studies of diets and stress the importance of the inclusion of nutritional quality indicators which go beyond kcal intake or macronutrient ratios. This work was supported by the French AGRALID project (ANR-12-ALID-0003)

TU256

Impacts of food consumption: a missing hot spot in LCA?

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Use stage (i.e. food consumption) impacts are inconsistently accounted for within LCA and likely constitute a hot spot of considerable magnitude with respect to human health impacts of food systems. As case study examples, methods are lacking to assess global and regional nutritional impacts and to account for exposure to chemicals within food contact materials (e.g. packaging). This study's objectives are to develop methodologies to address *consumption* of food products and associated impacts as a potential hot spot within LCA. We extend life cycle thinking (LCT) to a broader disciplinary context to raise awareness in the LCA community about global and regional public health "hot spots", e.g. identified through epidemiology. Data is collected to build an inventory of chemicals within food packaging materials, and we estimated and characterized exposure, and identified major research gaps and areas of prioritisation. Also to investigate consumption as a potential hot spot, regional and global epidemiology-based models were developed to estimate disability adjusted life years (DALYs) associated with various dietary unit-mass intakes (e.g. gram of sodium). Applying life cycle thinking (LCT) and a broader disciplinary context can help redirect environmental sustainability assessments towards priority regional and global human health issues specifically with respect to food systems.

TU257

Joint assessment of environmental Life Cycle Assessment results and grape quality using multicriteria evaluation with fuzzy logic

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Life Cycle Assessment (LCA) addresses different environmental impacts so that it provides a set of indicators results that can be contradictory. Deciding as well as comparing systems on more than one criteria becomes rapidely an impossible task. This becomes even more complicated when the number of indicators is increased by broadening the assessement to other issue like product quality.The objective of this work is to agregate a large number of LCA results which could be compared with the product quality assessment of a vine plot. LCA results can be aggregated by means of a tool called CONTRA (TRAnsparent CONstruction of decision trees). CONTRA is a method using fuzzy inference system to avoid threshold effects in aggregation. This tool aggregate several indicators into a single quantitative score. The advantage of such a method, when applied to LCA, is thus to study the LCA of a system through a single result in order to compare it to a single score obtained in the same way from product quality assessment. The comparison of environmental and quality issues is then simplified to the comparison of two scores. The first step consisted in defining with experts the decision tree: selection of criteria and their organization. Then, the evaluation model was constructed by defining the CONTRA parameters according to experts' opinion: definition of threshold values for each criteria, criteria weighting, and generic rules for the management of compensations between criteria. LCA's threshold values were defined by taking the extreme values obtained on a population of 5 vineyards, chosen to represent the diversity of viticultural practices for middle of Loire valley dry white wine grapes (France). Decision rules for compensations were decided to limit the compensation of a bad score on one criterium by a good one on another variable. CONTRA parameters that best correspond to these rules were then defined. The aggregation of results using CONTRA allowed an overall view of the LCA results of a system by producing a single synthetic score. Furthermore, CONTRA makes possible the analyze of the results more thoroughly backing up to the individual results and of environmental impacts and quality criteria, to identify elements to be improved and those to be maintained. Within this study, the use of CONTRA eased the comparison of environmental LCA results with another sustainability dimension, here the quality of the product.

TU258

Grape LCA : How to better assess organic and integrated technical management routes ?

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There is an increasing demand from society for informations on environmental impacts of products. In viticulture, there are a lot of different practices and there is a need for tools and methods that can give relevant informations on environmental impacts of these practices. Life Cycle Assessment (LCA) has been recently identified as a useful tool to develop more sustainable agricultural systems and as a relevant method to assess environemental impacts of agriculture on a plot scale. A method has been proposed by Renaud-Gentié et al. to assess environmental impacts of technical management routes (TMR) on a plot scale based on LCA. This study apply this methodology on two case studies and goes through methodological improvements needed for a better assessment of organic and integrated viticulture practices. Results show that the studied organic TMR has significantly more impacts on global warming potential, photochemical ozone formation potential and acidification potential. Concerning freshwater ecotoxicity potential and resource depletion, impact score difference between organic and integrated TMR is very small. The case study shows how current application of LCA methodology to viticulture is not sufficient to assess different types of viticulture. In this methodology, several major issues are not assessed fairly or not assessed at all. For example, adding a soil quality indicator among impact categories seems important as maintaining initial soil properties is a key issue for agriculture sustainability. Carbon sequestration in the soil is another important issue which is not taken into account in Grape LCA whereas existing good techniques in this field may be promoted by LCA. Concerning ecotoxicity, modelling of emissions to soil, water and air from copper and sulfur-based products (mainly used in organic agrilculture for pest management) doesn't exist. Finally, data used for fuel consumption of machinery are not totally satisfactory and can also be improved.

TU259

A new biophysical allocation in LCA of beef cattle coproducts: modelling energy requirements of body-tissues growth

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